

## DTC P2201

### Diagnostic Instructions

- Perform the [Diagnostic System Check - Vehicle](#) prior to using this diagnostic procedure.
- Review [Strategy Based Diagnosis](#) for an overview of the diagnostic approach.
- [Diagnostic Procedure Instructions](#) provides an overview of each diagnostic category.

### DTC Descriptors

#### DTC P2201

NOx Sensor 1 Performance

### Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
NOx Sensor Ignition Voltage	U029D, U029E, P220A, P220B	U029D, U029E	U029D, U029E, P220A, P220B	—
High Speed GMLAN Serial Data (+)	U0074, P205D	U010E, P205D	U0074, P205D	—
High Speed GMLAN Serial Data (—)	U029D, U029E, U010E, P205D	U010E, P205D	U010E, P205D	—
NOx Sensor Ground	—	U029D, U029E	—	—

### Circuit/System Description

The reductant system uses two nitrogen oxide (NOx) sensors to monitor the amount of NOx in the engine's exhaust gas. The first sensor is located at the outlet of the turbocharger and monitors the engine out NOx level. The second NOx sensor is located between the selective catalytic reduction (SCR) and the diesel particulate filter (DPF) and monitors NOx levels downstream of the SCR. The second NOx sensor also provides the engine control module (ECM) with information on the exhaust oxygen level during DPF regeneration.

Each NOx sensor contains a sensing cell, a pumping cell, and a heater. A sample of exhaust gas passes through a diffusion gap between the sensing cell and the pumping cell. The NOx sensor maintains a constant reference voltage across the sensing cell. An electronic circuit within sensor controls the pump current through the pumping cell in order to maintain a constant voltage in the sensing cell. The amount of current required to maintain the reference voltage in the sensing cell is proportional to the concentration of NOx in the exhaust.

The ECM varies the amount of diesel exhaust fluid (DEF) or reductant added by varying the reductant injector duty cycle in response to changes in engine exhaust out NOx levels.

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The smart NOx sensors consist of two components, the NOx module and the NOx sensor element that are serviced as a unit. A circuit or performance condition with a NOx sensor is detected by the NOx sensor module. The smart NOx sensor module communicates the condition to the ECM over the serial data line. The ECM sets a DTC when a serial data message is received from the NOx sensor module.

### **Conditions for Running the DTCs**

- The engine run time is greater than 10 s.
- The engine speed is greater than 600 RPM.
- The battery voltage is greater than 11 V.
- The DPF regeneration is not active.
- The DTC runs continuously when the above conditions are met.

### **Conditions for Setting the DTC**

The ECM receives a serial data message from the NOx Sensor Module that the time it takes for the NOx concentration level to fall from 70% to 40% of the initial NOx concentration value is greater than 2.3 s.

### **Action Taken When the DTC Sets**

DTC P2201 is a Type B DTC.

### **Conditions for Clearing the DTC**

DTC P2201 is a Type B DTC.

### **Diagnostic Aids**

In order for the NOx 1 NOx Concentration and NOx 2 NOx Concentration to indicate greater than 0 ppm, the vehicle must be driven until the EGT sensor 3 is greater than 250°C (482°F).

### **Reference Information**

#### **Schematic Reference**

[Engine Controls Schematics](#)

#### **Connector End View Reference**

[Component Connector End Views](#)

#### **Description and Operation**

[Exhaust Aftertreatment System Description](#)

#### **Electrical Information Reference**

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

#### **DTC Type Reference**

[Powertrain Diagnostic Trouble Code \(DTC\) Type Definitions](#)

#### **Scan Tool Reference**

Control Module References for scan tool informationCircuit/System Verification

1. Ignition ON, observe the DTC information with a scan tool. DTC UXXXX should not be set.

⇒ **If a DTC is set**

Refer to Diagnostic Trouble Code (DTC) List - Vehicle for further diagnosis.

↓ **If no DTC is set**

2. Verify the following conditions do not exist:

- Intake system leaks—Refer to Charge Air Cooler Diagnosis.
- Exhaust system leaks — Refer to Exhaust Leakage
- A loose or disconnected charge air cooler hose or pipe
- Physical damage
- Soot plugged B195 NOx sensor
- Loose or missing hardware
- Loose B195 NOx sensors or B131 exhaust temperature sensors

⇒ **If a condition is found**

Repair the intake or exhaust system.

↓ **If no condition is found**

3. Engine running.

4. Verify NOx1 NOx Concentration and NOx2 NOx Concentration are greater than 0 ppm.

**Warning:** Road test a vehicle under safe conditions and while obeying all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

5. Accelerate vehicle to 80 km/h (50 mph) and hold for 20 s, then decelerate for 10 s.

⇒ **If the DTC fails**

Replace the faulty B195 NOx sensor.

↓ **If the DTC passes**

6. All OK.

Repair Instructions

- Nitrogen Oxide Sensor Replacement - Position 1
- Perform the scan tool NOx Sensor 1 Reset procedure after replacing the NOx sensor 1.
- Control Module References for engine control module replacement, programming, and setup

Repair Verification

1. Install any components or connectors that have been removed or replaced during diagnosis.
2. Perform any adjustment, programming, or setup procedures that are required when a component or module is removed or replaced.
3. Clear the DTCs.
4. Ignition OFF, all vehicle systems OFF, this may take up to 2 minutes.

**Warning:** Road test a vehicle under safe conditions and while obeying all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

5. In order to clear the DEF lamp, idle the engine at operating temperature. Accelerate at part throttle to 32–48 km/h (20–30 mph) for up to 5 minutes or until the DEF lamp turns OFF. The DEF lamp should turn OFF.

⇒ If the DEF lamp does not turn OFF, a condition with the system still exists.